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NRO REVIEW COMPLETED

23 July 1962

MEMORANDUM FOR : The Record

SUBJECT : Recent Significant Developments
OXCART Engine Program

25X1 REFERENCE : [redacted] dated 21 June 1962
"Status - OXCART Engine Program"

1. Delivery Engines:

a. Changes:

Since delivery of engine YJ-1 for airplane fit check on 11 June 1962 changing conditions have dictated the necessity that certain engineering changes be incorporated prior to flight. Some but not all of these changes were anticipated and authorized prior to release of referenced memorandum. Until 11 July the total of these changes stood at 15. On this date, Headquarters was visited by the contractor who advised of the necessity, as based upon his best conservative engineering judgement, that additional changes involving mainly engine plumbing be incorporated as well. A detailed review conducted by the writer in Florida on 17 July places the total of these changes at 26. Group breakdown is as follows:

(1) Afterburner Fuel Manifold Coupling:

The interim fix for this intermittent leakage as reported in referenced memorandum proved not to be successfully repeatable on all engines tested. This necessitated incorporation of the longer lead time production fix involving replacement of the coupling with a four bolt flange configuration. This item is pacing with hardware availability targeted for 1 August with subsequent assembly and test operations.

(2) Thrust Monotonicity:

Hardware for correcting this operational problem surfaced in May and covered by referenced memorandum is not pacing.

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(3) Engine/Airframe Installation:

Twelve changes involving plumbing, brackets, and instrumentation are required for installation compatibility. Eleven of these result directly from physical interferences with airframe parts as surfaced during fit check on 22 June.

(4) Aircraft Installed Engine Starting:

Four changes involving an adapter plate, main fuel control cam, ignition timing, and dump valve timing are required in order to start an installed engine. The latter three were surfaced during engine starting tests 3 July when using the Lockheed, [redacted] starter with a simulated Lockheed airframe inlet in Florida. Incorporation of the simulated inlet created a pressure drop at the engine face resulting in a different engine fuel flow schedule requirement with revised attendant ignition and dump valve timing in addition to increased torque required from the starter. Ignition timing which requires a manual cockpit switch has been in coordination with Lockheed since at least 5 July. A new fuel flow schedule was established and coordinated with [redacted] changes on 12 July. Hardware target for the new control with recut cam is 4 August. This item is potentially pacing.

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(5) Plumbing Durability:

Eight changes designed to improve plumbing durability have been added to the "must conform" list since 10 July. Six of these changes involve the strengthening or elimination of standpipes. Standpipe elimination has been planned as an improvement program since the change from brazed to mechanical fittings in 1961. Until very recently, it was intended that these and other changes would be retrofitted into delivery engines during overhaul. Recent development engine testing has revealed leaks in some of the pipes covered by these six changes but always with extenuating circumstances such as evidence of improper handling, wrenching, or assembly thus nevertheless casting the shadow of a doubt. Along with the above, these changes cover the elimination of all standpipes from the high pressure side of the hydraulic system even though no leaks have been revealed. In order to remove these doubts, it is [redacted] best engineering judgment that these changes which represent the first phase of this program be incorporated prior to flight. These changes are not now pacing.

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(6) Accessory Drive Shaft:

Two minor non gaging changes to the accessory drive shaft involve the incorporation of improved o-ring seals for the shaft cover housing and a changed shaft shear section location.

b. Schedule:

The impact of the above changes together with the requirement that they be done in Hartford dictates the redelivery of the first engine on 15 August with the second following on 31 August. A comparison of the new probable deliveries with the existing official schedule through December 1952 is presented herewith:

	Official		Probable	
	Delivery	Cumulative	Delivery	Cumulative
June	1	1		
July	2	3		
August	1	4	2	2
September	3	7	4	6
October	4	11	3	9
November	5	16	3	12
December	5	21	4	16

2. Back-up Starting Systems:

25X1 Requirements exist at [redacted] for two separate back-up engine starting systems for two separate and distinct reasons. Each system is discussed separately as follows:

a. Engine Test Stand:

Because of repetition of mechanical difficulty with and the very lean quantity (3 procured) of the Lockheed, [redacted] 25X1
starter unit, Pratt & Whitney was asked 3 July and now has in
25X1 place at [redacted] an air turbine starting system to be used as a

back-up for the engine test stand. This system comprises two air turbine starters and a special engine mountable gearbox. Headquarters is procuring from USAF three ground air supply units, two being required for the two air turbines for each start and one as a spare. One unit is now in place, the second unit is ready for delivery, and the third is in final assembly. Although several successful J58 engine starts were made last week at [redacted] with the Lockheed, [redacted] 25X1 25X1
[redacted] starter, mechanical difficulties with the sole unit available were again encountered substantiating the need for the back-up capability described above.

b. Airplane:

Because of recent sea level engine starting test results which indicate a very marginal torque capability of the Lockheed/ [redacted] 25X1 starter unit when used with the Lockheed airframe simulated inlet mounted to the engine face, Pratt & Whitney has taken the initiative with Headquarter's approval to design and procure a jury rig back-up air turbine starting system for starting an airframe installed J58 engine. This system differs from the test stand system described above in that three air turbine starters will be used per start because of the additional torque required due to inlet depression and also altitude/hot day, and a special semi-portable "plug-in" gearbox is required because of airframe engine nacelle geometry. This system, of which the first of three is targeted for a 15 August delivery, will at best be heavy and crude but better than nothing in the event the Lockheed [redacted] unit fails. Lockheed was officially queried 11 July by Headquarters as to whether they will need ground air supply units for this system, three of which (similar to those being procured for the test stand system) will be required for each installed engine start. Availability of these units is limited. 25X1

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3. Mach 3.2 Engine Qualification:

Because of a turbine failure on engine FX-115 on 24 June at 7 hours of Mach 3.2 endurance which has been attributed to thermal shock

resulting from successive hot starts, the Mach 3.2 qualification has been delayed. Since the release of referenced memorandum the burner can center tube burning problem cited therein has demonstrated repeatable improvement on engine test and is not now posing. Some new and previously recognized factors bearing on this qualification are:

a. Successful durability demonstration on engine test of the plumbing standpipe reconfiguration cited in paragraph 1a(5). This demonstration should be completed in early August.

b. The main fuel control Mach 3.2 qualification rerun on 30 June cited in referenced memorandum would have been successful had it not been for a temperature sensor servo failure at 25 hours. This servo was isolated and the test continued to 50 hours successfully. The servo failure has been attributed to lack of nitride in the piston bore, a quality control responsibility. Rerun of the test is targeted for 30 July.

25X1 c. At [redacted] the initial hydraulic pump break-in test piston/bore wear problem cited in referenced memorandum has grown to large proportions. Deliveries have been seriously delayed pending isolation of the problem believed to be associated with the piston flare plating process. A combined joint Pratt & Whitney, [redacted] 25X1 effort has not pinpointed the problem to date, however, preliminary results of pump testing conducted over the last weekend indicate that by a general tightening of all manufacturing process specifications some pumps are again passing test. Since this problem has been associated solely with the F pump (Mach 3.2 without oil additive), Pratt & Whitney indicates that if the F pump remains unavailable, the engine test might be conducted with a D pump using a new thermally stable additive.

d. Afterburner performance is now running very close (29,600 pounds) to the hoped for level required for 30,000 pounds total engine take off thrust targeted for the Mach 3.2 engine. This performance is not a limiting factor to the Mach 3.2 regime except that as much thrust as possible is desired to assure getting to Mach 3.2

Current best estimates indicate September for the Mach 3.2 qualification. Since this qualification represents a continuous rating, it may be possible pending initial limited engine flight experience to approve certain engines for intermittent short time excursions into the Mach 3 regime on an ad hoc basis prior to qualification test completion.

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4. <u>Periodic Meetings:</u>

Because of the increased tempo in the engine program, it is recommended that consideration be given to establishing a series of monthly or bi-monthly informal small meetings with the engine contractor preferably at his facility. The purpose of such meetings would be two-fold; to keep the DD/P personally appraised of anticipated fast changing conditions affecting the over-all program; and to give the contractor the benefit of the personal reactions and guidance of the DD/P on major issues. Development Division, OSA, has taken the liberty tentatively to plan one such meeting in early August.

SIGNED

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[redacted]
Development Division
OSA-DD/P

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